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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/647,380	KATOU ET AL.	
	Examiner	Art Unit	
	Jason R. Kurr	2615	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *29 May 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-12 and 14-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-12 and 14-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claims 2 and 13 have been cancelled and will not be considered by the Examiner.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless.–
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 3-4, 8, 10, 12,14-15 and 20 are rejected under 35 U.S.C. 102(b) as being anticipated by Aarts et al (US 6,111,960).

With respect to claim 1, Aarts discloses an audio-signal-processing apparatus comprising: a band-decomposition unit (fig.9 #20A-20N), having a decomposition characteristic, operable to decompose a low frequency component of input-audio-signals into a plurality of frequency components that have different frequency bands based on the decomposition characteristic (col.9 ln.15-19); a harmonic-series-generating unit (fig.9 #23A-23N) operable to generate a harmonic-tone component based on at least one of the plurality of frequency components (col.9 ln.11-12); and a composition unit (fig.9 #26) operable to compound the input-audio-signals and the harmonic-tone component generated by said harmonic-series-generating unit, wherein said band-decomposition unit is operable to decompose the low frequency component

of each of a fundamental tone and harmonic-tones of the fundamental tone initially in a same band such that each belongs to a different frequency band. The band-decomposition unit of Aarts functions to decompose the input signal into frequency bands of small bandwidths (ex.10Hz, see col.9 ln.15-19), hence if the fundamental and harmonic tones of an input signal differ by at least 10Hz, then the band-decomposition unit is operable to separate these tones into different frequency bands. (See "Response to Arguments" below).

With respect to claim 3, Aarts discloses the audio-signal-processing apparatus of claim 1, wherein each bandwidth of the plurality of frequency components is defined based on a lowest fundamental frequency of a particular musical instrument. The audible frequency range of the human ear is roughly 20Hz-20kHz, therefor the lowest perceivable fundamental frequency of a musical instrument would be around 20Hz. Aarts discloses that the lowest frequency band-pass filter (fig.9 #20A) passes signals at a low frequency corner of 20Hz; hence the decomposition characteristic of the band-pass filter is defined by the lowest fundamental frequency of a musical instrument perceivable to the human ear. Aarts also decomposes the audio signal into bandwidths of 10Hz, which is a relatively small margin of frequencies with respect to the audible spectrum. Such small bandwidths of frequency bands can easily related to a low frequency baseband of a particular musical instrument.

With respect to claim 4, Aarts discloses the audio-signal-processing apparatus of claim 1, wherein each bandwidth of the plurality of frequency components is defined based on a low interval limit (col.9 ln.15-19).

With respect to claim 8, Aarts discloses the audio-signal-processing apparatus of claim 1, wherein said band-decomposition unit comprises a band-pass filter (fig.9 #20A) having a low cut-off frequency that is lower than a lowest fundamental frequency of a musical instrument (col.9 ln.15-19).

With respect to claim 10, Aarts discloses the audio-signal-processing apparatus of claim 1, further comprising a gain control device (fig.9 #23A-N, fig.4 #34) operable to adjust a gain of the input-audio-signals and a gain of the harmonic-tone component generated by said harmonic-series-generating unit (col.9 ln.11-15).

With respect to claim 12, Aarts discloses an audio-signal-processing method comprising: decomposing a low frequency component of input-audio-signals into a plurality of frequency components that have different frequency bands based on a decomposition characteristic (fig.9 #20A-N, col.9 ln.15-19); generating a harmonic-tone component based on at least one of the plurality of frequency components (fig.9 #23A-23N, col.9 ln.11-12); and compounding the input-audio-signals and the generated harmonic-tone component (fig.9 #26), wherein said decomposing comprises decomposing the low frequency component of each of a fundamental tone and harmonic-tones of the fundamental tone initially in a same band such that each belongs to a different frequency band. The band-decomposition unit (fig.9 #20A-20N) of Aarts functions to decompose the input signal into frequency bands of small bandwidths (ex.10Hz, see col.9 ln.15-19), hence if the fundamental and harmonic tones of an input signal differ by at least 10Hz, then the band-decomposition unit would separate these tones into different frequency bands (See "Response to Arguments" below).

With respect to claim 14, Aarts discloses the audio-signal-processing method of claim 12, wherein each bandwidth of the plurality of frequency components is defined based on a lowest fundamental frequency of a particular musical instrument. The audible frequency range of the human ear is roughly 20Hz-20kHz, therefor the lowest perceivable fundamental frequency of a musical instrument would be around 20Hz. Aarts discloses that the lowest frequency band-pass filter (fig.9 #20A) passes signals at a low frequency corner of 20Hz; hence the decomposition characteristic of the band-pass filter is defined by the lowest fundamental frequency of a musical instrument perceivable to the human ear. Aarts also decomposes the audio signal into bandwidths of 10Hz, which is a relatively small margin of frequencies with respect to the audible spectrum. Such small bandwidths of frequency bands can easily related to a low frequency baseband of a particular musical instrument.

With respect to claim 15, Aarts discloses the audio-signal-processing method of claim 12, wherein each bandwidth of the plurality of frequency components is defined based on a low interval limit (col.9 ln.15-19).

With respect to claim 20, Aarts discloses the audio-signal-processing method of claim 12, further comprising adjusting a gain (fig.9 #23A-N, fig.4 #34) of the input-audio-signals and a gain of the generated harmonic-tone component (col.9 ln.11-15).

Claim 11 is rejected under 35 U.S.C. 102(b) as being anticipated by Klayman (US 6,285,767 B1).

With respect to claim 11, Klayman discloses an audio-signal-processing apparatus comprising: a sum component output unit (fig.8 #806) operable to receive input-audio-signals of a first channel (fig.8 #802) and input-audio-signals of a second channel (fig.8 #804) and output a sum component of the input-audio-signals of the first channel and the input-audio-signals of the second channel; a band-decomposition unit (fig.8 #812-815), having a decomposition characteristic, operable to decompose the sum component into a plurality of frequency components that have different frequency bands based on the decomposition characteristic; a harmonic-series-generating unit (fig.8 #810) operable to generate a harmonic-tone component based on at least one of the plurality of frequency components (col.14 ln.37-50); a first composition unit (fig.8 #824) operable to compound the input-audio-signals of the first channel and the harmonic-tone component generated by said harmonic-series-generating unit; and a second composition unit (fig.8 #832) operable to compound the input-audio-signals of the second channel and the harmonic-tone component generated by said harmonic-series-generating unit, wherein said band-decomposition unit is operable to decompose the low frequency component of each of a fundamental tone and harmonic-tones of the fundamental tone initially in a same band that each belongs to a different frequency band. (See "Response to Arguments" below).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 5-7 and 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aarts et al (US 6,111,960).

With respect to claim 5, Aarts discloses the audio-signal-processing apparatus of claim 1, however does not disclose expressly wherein a bandwidth of each of the different frequency bands is from 15 Hz to 50 Hz. Aarts discloses wherein the bandwidth is 10 Hz. At the time of the invention it would have been obvious to a person of ordinary skill in the art to increase the bandwidth of the band pass filters of Aarts to a greater range such as 15 Hz to 50 Hz, while still maintaining a relatively small bandwidth for the purpose of minimizing intermodulation distortion as taught by Aarts (col.9 ln.21-23). The motivation for increasing the bandwidth of the band pass filters of Aarts would have been to decrease the number of filters needed to cover the same range of low frequencies. This would ultimately lower the production costs of the circuit.

With respect to claim 6, Aarts discloses the audio-signal-processing apparatus of claim 1, however does not disclose expressly wherein a band width of each of the different frequency bands is from 15 Hz to 30 Hz. Aarts discloses wherein the bandwidth is 10 Hz. At the time of the invention it would have been obvious to a person of ordinary skill in the art to increase the bandwidth of the band pass filters of Aarts to a greater range such as 15 Hz to 30 Hz, while still maintaining a relatively small bandwidth for the purpose of minimizing intermodulation distortion as taught by Aarts

(col.9 ln.21-23). The motivation for increasing the bandwidth of the band pass filters of Aarts would have been to decrease the number of filters needed to cover the same range of low frequencies. This would ultimately lower the production costs of the circuit.

With respect to claim 7, Aarts discloses the audio-signal-processing apparatus of claim 1, however does not disclose expressly in the embodiment shown in figure 9 wherein said band-decomposition unit comprises a low-pass filter operable to extract frequency components in a lowest register. Aarts discloses in the embodiments shown in figures 1,2,4 and 5, wherein a low-pass filter extracting frequency components prior to be processed by a harmonic generating unit. At the time of the invention it would have been obvious to a person of ordinary skill in the art to use the low-pass filter disclosed in figures 1,2,4 and 5 in the embodiment shown in figure 9. The motivation for doing so would have been to block any high pass signals from reaching the harmonic generating unit, thus eliminating unwanted distortions.

With respect to claim 16, Aarts discloses the audio-signal-processing method of claim 12, however does not disclose expressly wherein a bandwidth of each of the different frequency bands is from 15 Hz to 30 Hz. Aarts discloses wherein the bandwidth is 10 Hz. At the time of the invention it would have been obvious to a person of ordinary skill in the art to increase the bandwidth of the band pass filters of Aarts to a greater range such as 15 Hz to 30 Hz, while still maintaining a relatively small bandwidth for the purpose of minimizing intermodulation distortion as taught by Aarts (col.9 ln.21-23). The motivation for increasing the bandwidth of the band pass filters of

Aarts would have been to decrease the number of filters needed to cover the same range of low frequencies. This would ultimately lower the production costs of the circuit.

With respect to claim 17, Aarts discloses the audio-signal-processing method of claim 12, however does not disclose expressly in the embodiment shown in figure 9 wherein said decomposing comprises decomposing the low frequency component of the input-audio-signals into the plurality of frequency components that have the different frequency bands based on the decomposition characteristic with a low-pass filter operable to extract frequency components in a lowest register. Aarts discloses in the embodiments shown in figures 1,2,4 and 5, wherein a low-pass filter extracting frequency components prior to be processed by a harmonic generating unit. At the time of the invention it would have been obvious to a person of ordinary skill in the art to use the low-pass filter disclosed in figures 1,2,4 and 5 in the embodiment shown in figure 9. The motivation for doing so would have been to block any high pass signals from reaching the harmonic generating unit, thus eliminating unwanted distortions.

With respect to claim 18, Aarts discloses the audio-signal-processing method of claim 12, however does not disclose expressly wherein a bandwidth of each of the different frequency bands is from 15 Hz to 50 Hz. Aarts discloses wherein the bandwidth is 10 Hz. At the time of the invention it would have been obvious to a person of ordinary skill in the art to increase the bandwidth of the band pass filters of Aarts to a greater range such as 15 Hz to 50 Hz, while still maintaining a relatively small bandwidth for the purpose of minimizing intermodulation distortion as taught by Aarts (col.9 ln.21-23). The motivation for increasing the bandwidth of the band pass filters of

Aarts would have been to decrease the number of filters needed to cover the same range of low frequencies. This would ultimately lower the production costs of the circuit.

Claims 9 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aarts et al (US 6,111,960) "Aarts-A" in view of Aarts et al (US 6,961,435 B2) "Aarts-B".

With respect to claim 9, Aarts-A discloses the audio-signal-processing apparatus of claim 1,however does not disclose expressly further comprising a delay device operable to compensate for a processing delay between the harmonic-tone component and the input-audio-signals.

Aarts-B discloses a delay device (fig.6 "TD6") operable to compensate for a processing delay between an input-audio-signal and a harmonic tone generator (fig.6 "BD6")(col.4 ln.6-18).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to use the delay device of Aarts-B in the invention of Aarts-A.

The motivation for doing so would have been to compensate for the time delay imposed by the harmonic generating device, thus the input signal and the harmonic signals would be added in synchronization allowing for an appropriate representation of the original signal.

With respect to claim 19, Aarts-A discloses the audio-signal-processing method of claim 12, however does not disclose expressly further comprising compensating for a processing delay between the generated harmonic-tone component and the input-audio-signals.

Aarts-B discloses a delay device (fig.6 "TD6") operable to compensate for a processing delay between an input-audio-signal and a harmonic tone generator (fig.6 "BD6")(col.4 ln.6-18).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to use the delay device of Aarts-B in the invention of Aarts-A.

The motivation for doing so would have been to compensate for the time delay imposed by the harmonic generating device, thus the input signal and the harmonic signals would be added in synchronization allowing for an appropriate representation of the original signal.

Response to Arguments

Applicant's arguments filed May 29, 2007 have been fully considered but they are not persuasive.

With regard to independent claims 1, 11 and 12, the Applicant argues that Aarts et al (US 6,111,960) fails to teach or suggest wherein the "band decomposition unit is operable to decompose the low frequency component of each of a fundamental tone and harmonic-tones of the fundamental tone initially in a same band such that each belongs to a different frequency band". The Examiner disagrees with this assertion. Harmonics are well known to be multiples of the fundamental frequency or tone (f) wherein the first harmonic is the fundamental frequency or tone (f), the second harmonic occurs at twice the fundamental frequency (2f), the third harmonic occurs at three times the fundamental frequency (3f), and so on. Aarts teaches that the band

pass filters #20A-N breaks the signal into bands of 10Hz bandwidths beginning with 20-30Hz, then 30-40Hz, etc. (col.9 ln.15-20). Here it can be clearly seen that if a fundamental tone occurs at the lowest audible frequency 20Hz, then the next possible harmonic (i.e. second harmonic 2f) would occur at 40Hz. The teaching of Aarts clearly decomposes these two frequencies (20 and 40 Hz) into two different bands, thus separating the fundamental tone from the harmonic tones.

The same can be said with respect to the rejection of claim 11 in view of Klayman. Klayman's band pass filters are tuned to frequencies of 100 Hz, 150 Hz, 200 Hz, and 250 Hz. Any fundamental tone occurring at these frequencies would have harmonics occurring at frequencies outside of the band of the fundamental tone, thus the band pass filters separate the fundamental tone from the harmonic tones.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason R. Kurr whose telephone number is (571) 272-0552. The examiner can normally be reached on M-F 10:00am to 6:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vivian Chin can be reached on (571) 273-7848. The fax phone number for the organization where this application or proceeding is assigned is 571-273-0552.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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